material from the cells. These elements preferably operate differently from a valve, which would completely obstruct passage of material between upstream and downstream locations adjacent the valve. Rather, they typically provide resistance to fluid flow at a desired location (the lysing position) to thereby control fluid placement.

In one embodiment, the positioning element is disposed downstream of the lysing mechanism to position an upstream portion of a cell-containing sample (such as a microdroplet) in the lysing position. The positioning element preferably increases a surface tension of a downstream surface of the cell-containing sample to thereby inhibit downstream movement of the sample. For example, the positioning element may include an amount of reduced-wetting material, such as a hydrophobic material, disposed to contact a portion of the downstream surface of the cell-containing microdroplet.

In another embodiment, the positioning element is disposed upstream of the lysing zone to position a downstream portion of the cell-containing microdroplet in the lysing position. The positioning element includes a vent, which substantially equalizes a gas pressure upstream of the cell-containing microdroplet with a gas pressure downstream of the cell-containing microdroplet to thereby stop downstream movement of the cell-containing microdroplet. When the microdroplet is in the lysing position. A valve is preferably disposed to ~~subsequent~~ subsequently obstruct passage of gas between the lysing zone and the vent to allow an upstream gas pressure to once again move the droplet further downstream for additional processing. For example, the microfluidic system may include a mixing zone downstream of the enrichment zone and/ or lysing zone, to mix the microdroplet which emerges from these zones with a predetermined amount of reagent material.

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In another aspect, the invention relates to a microfluidic substrate for processing the intracellular contents of cells suspended in fluids. The substrate includes a lysing module, a microdroplet formation module, mixing module and an amplification module. The lysing module releases intracellular material from cells within the sample to thereby form a ~~lyced~~ lysed sample. The microdroplet formation module then forms a first microdroplet of fluid from the lysed sample and forwards it to a mixing module for mixing with a microdroplet of reagent. The amplification module amplifies intercellular material within the microdroplet formed from the mixture.

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